# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

| Applicant's or agent's file reference | FOR FURTHER ACTION | See Form PCT/IPEA/416 |
|---|---|---|
| P206350PCT AWE/do | | |
| International application No. | International filing date *(day/month/year)* | Priority date *(day/month/year)* |
| PCT/NL2004/000180 | 12.03.2004 | 14.03.2003 |
| International Patent Classification (IPC) or national classification and IPC | | |
| F16H3/14, F16H63/30 | | |
| Applicant | | |
| AB SKF et al. | | |

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 5 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

| | | |
|---|---|---|
| ☒ | Box No. I | Basis of the opinion |
| ☐ | Box No. II | Priority |
| ☐ | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| ☐ | Box No. IV | Lack of unity of invention |
| ☒ | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| ☐ | Box No. VI | Certain documents cited |
| ☐ | Box No. VII | Certain defects in the international application |
| ☐ | Box No. VIII | Certain observations on the international application |

| Date of submission of the demand | Date of completion of this report |
|---|---|
| 04.01.2005 | 28.01.2005 |
| Name and mailing address of the international preliminary examining authority: | Authorized Officer |
| European Patent Office - P.B. 5818 Patentlaan 2<br>NL-2280 HV Rijswijk - Pays Bas<br>Tel. +31 70 340 - 2040 Tx: 31 651 epo nl<br>Fax: +31 70 340 - 3016 | Van Prooijen, T<br>Telephone No. +31 70 340-3180 |

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/NL2004/000180

## Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

| **Description, Pages** | |
|---|---|
| 2-4 | as originally filed |
| 1, 1a | received on 04.01.2005 with letter of 04.01.2005 |
| **Claims, Numbers** | |
| 1-7 | received on 04.01.2005 with letter of 04.01.2005 |
| **Drawings, Sheets** | |
| 1/4-4/4 | as originally filed |

   ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | | |
|---|---|---|---|
| Novelty (N) | Yes: | Claims | 1-7 |
| | No: | Claims | |
| Inventive step (IS) | Yes: | Claims | 1-7 |
| | No: | Claims | |
| Industrial applicability (IA) | Yes: | Claims | 1-7 |
| | No: | Claims | |

2. Citations and explanations (Rule 70.7):

**see separate sheet**

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

Subject: forward- reverse control device

Closest prior art: GB-A-591 153 shows such a device having the features of the preamble of claim 1

Problem: to simplify the design. The known design uses a planetary carrier which is axially moved by the actuator

Solution: by the characterizing features of the independent claim. Although planetary gear arrangements in which the planetary gears are fixed to the housing are known, it would not seem to be obvious to arrive at such a construction starting from the prior art construction, since in order to have this feature many more alterations to the prior art are necessary.

Thus claim 1 and dependent claims 2 to 7 meet the requirements of Articles 33(2) and 33(3) PCT.

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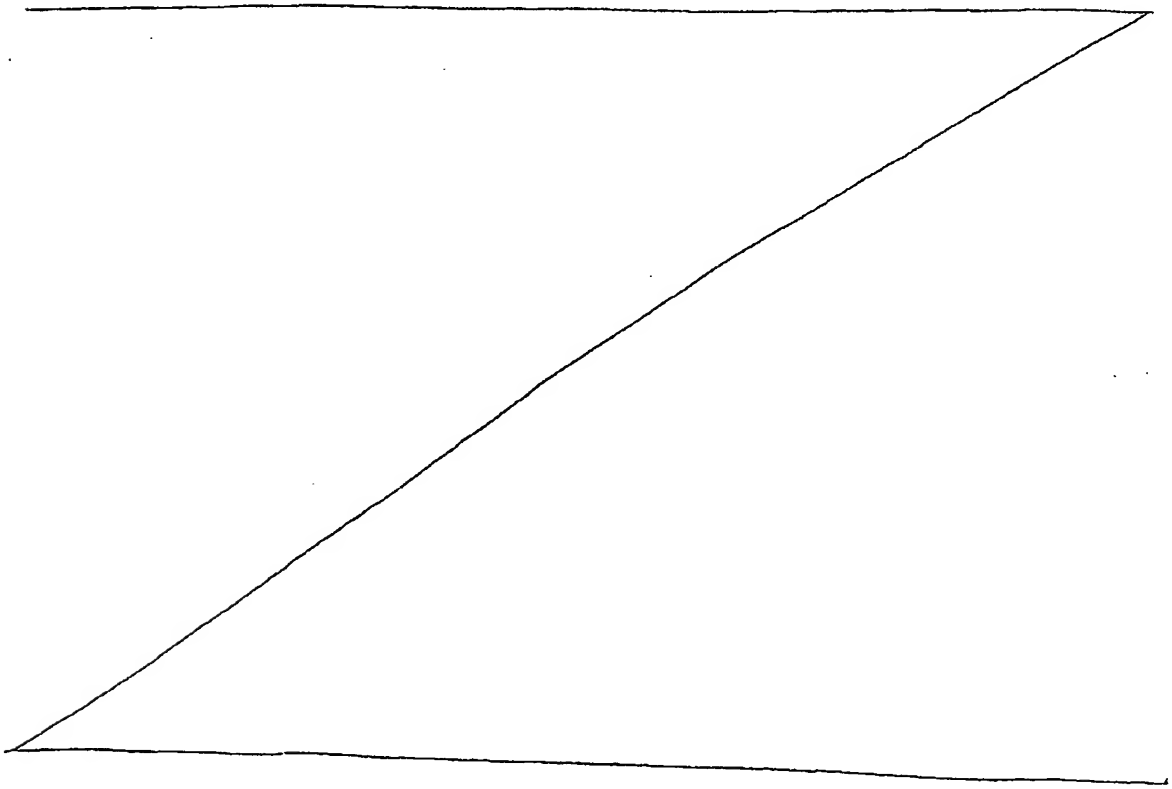
# Forward-reverse control device

The invention is related to a forward-reverse control device, comprising a housing, a rotatable input member, a rotatable output member, a planetary gear set for reversing the input rotation, as well as selector means for selectively connecting the input member and the output member directly or through the gear set, wherein the selector means are driveable by means of an electric actuator.

Such a forward-reverse control is disclosed in GB-A-591153. The planetary gear set thereof is mounted on a rotatable planet carrier.

The object of the invention is to provide a forward-reverse control which is of a simpler design. Said object is achieved in that each satellite gear of the planetary gear set is rotatably connected with respect to the housing, said housing furthermore supporting the screw mechanism and the electric motor.

The actuator may comprise an electric/mechanical converter for converting rotational motion into linear motion, e.g. a ball/screw mechanism connected to an electric motor. The ball screw mechanism may be a friction screw, a ball screw or a roller screw mechanism.



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# Forward-reverse control device

The invention is related to a forward-reverse control device, comprising a housing, a rotatable input member, a rotatable output member, a gear set for reversing the input rotation, as well as selector means for selectively connecting the input member and the output member directly or through the gear set.

Such a forward-reverse control device is known. It can for instance be applied in an automotive vehicle driveline including a continuously variable transmission. The object of the invention is to provide an improved independent forward-reverse control mechanism which can be applied in connection with drive-by-wire applications, in particular in connection with a drive-by-wire continuously variable transmission. The CVT by wire transmission may incorporate, apart from the forward reverse control by wire, also a disc variator by wire, clutch by wire with or without integrated starter generator, a differential with or without traction control and also a parking by wire control.

Said object is achieved in that the selector means are driveable by means of an electric actuator. Said actuator comprises an electric/mechanical converter for converting rotational motion into linear motion, e.g. a ball/screw mechanism connected to an electric motor. The ball screw mechanism may be a friction screw, a ball screw or al roller screw mechanism.

Preference is given to an embodiment in which each satellite gear of the planetary gear set is rotatably connected with respect to the housing, said housing furthermore supporting the screw mechanism and the electric motor. The selector means may comprise a toothed selector wheel which is displaceable in axial direction, a first counter wheel which is connected to the input member, a second counter wheel which is connected to the output member, as well as a third counter wheel which is connected to the ring gear of the planetary gear set and which is positioned between the first and the second counter wheel when seen in axial direction, said selector wheel being displaceable between a first position engaging both the third and the first counter

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Claims

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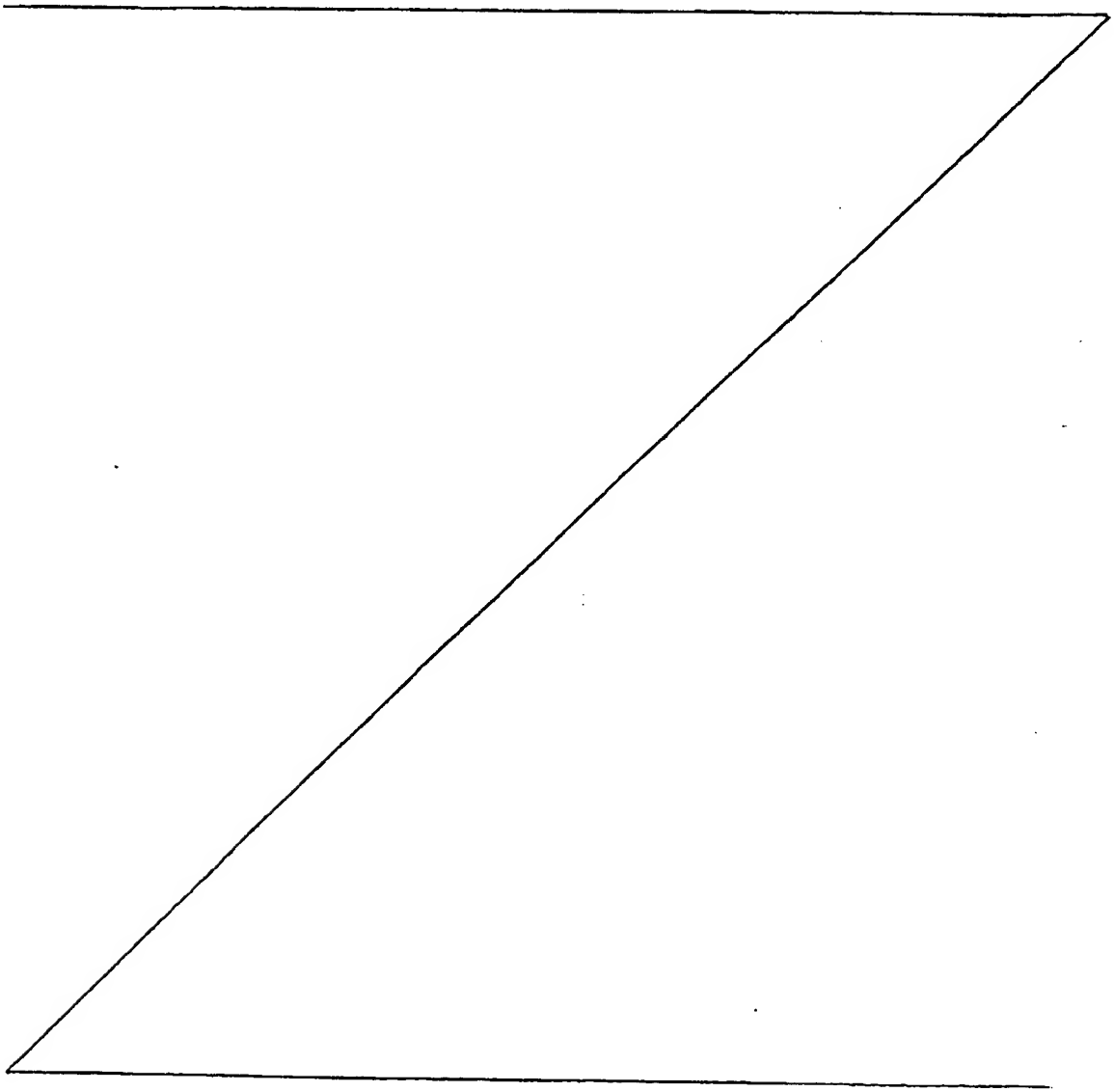
1. Forward-reverse control device, comprising a housing (1), a rotatable input member (4), a rotatable output member (2), a planetary gear (10) set for reversing the input rotation, as well as selector means (6-8, 15) for selectively connecting the input member (4) and the output member (2) directly or through the gear set (10), wherein the selector means (6-8, 15) are driveable by means of an electric actuator (16, 17, 21-24), characterized in that each satellite gear (25) of the planetary gear set (10) is rotatably connected with respect to the housing (1), said housing (1) furthermore supporting the screw mechanism (16) and the electric motor (24).



Claims

1. Forward-reverse control device, comprising a housing (1), a rotatable input member (4), a rotatable output member (2), a gear set (10) for reversing the input rotation, as well as selector means (6-8, 15) for selectively connecting the input member (4) and the output member (2) directly or through the gear set (10), characterized in that the selector means (6-8, 15) are driveable by means of an electric actuator (16, 17, 21-24).

2. Device according to claim 1, wherein the electric actuator comprises an electric/mechanical converter for converting rotational motion into linear motion, e.g. a ball/screw mechanism (16) connected to an electric motor (24).

3. Device according to claim 2, wherein the linear screw mechanism (16) is a friction screw, a ball screw or al roller screw mechanism.

4. Device according to any of the preceding claims, the gear set is a planetary gear set (10), wherein each satellite gear (25) of the planetary gear set (10) is rotatably connected with respect to the housing (1), said housing (1) furthermore supporting the screw mechanism (16) and the electric motor (24).

5. Device according to any of the preceding claims, wherein the selector means (6-8, 15) comprises a toothed selector gear wheel (15) which is displaceable in axial direction, a first counter gear wheel (7) which is connected to the input member (4), a second counter gear wheel (6) which is connected to the output member (2), as well as a third counter gear wheel (8) which is connected to the ring gear (9) of the planetary gear set (10), the second counter gear wheel (6) being positioned between the first (7) and the third counter gear wheel (8) when seen in axial direction, said selector gear wheel (15) being displaceable between a first position engaging both the second (6) and the first (7) counter gear wheel, and a second position engaging the second (6) and the third (8) counter gear wheel.

6. Device according to claim 5, wherein the screw (17) of the screw mechanism (16) is rotatably supported with respect to two axially spaced support rings (18, 19), said support rings (18, 19) each being suspended with respect to the housing (1) by means of suspension rods (20) extending between the ring gear (9) and the sun gear (12) of the satellite gear set (10), and the nut (21) of the screw mechanism (16) is connected to the selector wheel (15).

7. Device according to claim 5 or 6, wherein synchronizer mechanisms (13, 14) are provided between the second (6) and the first (6) counter wheel as well as between the second (6) and the third (8) counter wheel.

8. Device according to claim 5, 6 or 7, wherein the input member (4) is connected to the sun wheel (12), and the third counter wheel (8) is connected to the ring gear (9) of the satellite gear set (10).